MECHANICS OF FLUIDS

Expected 2marks and 16marks

Most of the questions are asked from the given below qns..Check the previous year qpaper for reference

Unit –I

Part – A

1. Define Fluids.

2. Classify The Different Types Of Fluids.

3. What Are The Properties Of Ideal Fluids.

4. Distinguish Between Ideal And Real Fluids.

5. Why Are Some Fluids Classified As Newtonian Fluids? Give Example To Newtonian Fluids.

6. What Are Non-Newtonian Fluids?

7.Define The Term Density.

8.Define The Term Specific Volume.

9.Define Specific Weight.

10. Distinguish Between Mass Density And Specific Weight.

11. What Is Specific Gravity? How Is It Related To Density?

12.Define The Term Pressure. What Are Its Units?

13. Define The Term Absolute Temperature.

14. State Pascal's Law.

15. What Is Meant By Stagnation Pressure?

16. What Is The Difference Between Gauge Pressure And Absolute Pressure?

17. What Is Compressibility Of Fluids?

18. Define Compressibility And Viscosity Of A Fluid.

19. State The Newton's Law Of Viscosity

20. Define Dynamic Viscosity.

21. Define The Kinematic Velocity Of Fluid.

22. Define Relative Or Specific Viscosity.

23. What Is Viscosity? What Is The Cause Of It In Liquids And In Gases?

24. What Is The Effect Of Temperature On Viscosity Of Water And That Of Air.

25. What Is Cohesion In Fluids ?

26. What Is Adhesion In Fluids?

27. What Is Surface Tension?

28. Write The Equation Of Surface Tension Of Liquid Jet, Liquid Droplet And Soap Bubble.

29. Define Capillarity.

30. What Are The Parameters Depending On The Magnitude Of Capillary?

31. Explain The Effect Of Property Of Capillarity

32. Explain Capillary Depression.

33. Express 3m Of Water Head In Cm Of Mercury And Pressure In Kpa.

34. "No Slip Condition Is Applicable To

35. The Unit Of Viscosity In SI System Is

36. One Stroke Is Equal To

37. One Poise Is Equal To

38. What Is Meant By Continuum?

39. What is control Volume?

Part –B

1. What are the different types of fluids? Explain each type.

2. Define capillary, surface tension and state the factors that affect them?

3. Define Fluid density, specific weight and specific gravity?

4. Define the term Vapour pressure and capillarity?

5. Explain the following terms? 1. Dynamic Viscosity 2. Kinematic viscosity 3. Specific volume.

6. State Newton's law of viscosity and also define the coefficient of viscosity.

7. What is meant by continuum concept of the system?

8. What is control Volume?

9. Derive an expression for continuity equation?

10. Derive an expression for continuity equation in differential form?

Unit - II

Part – A

1. State Pascal's law?

2. State hydrostatic equation?

3. What is Absolute pressure, Gauge pressure and vacuum pressure?

4. What are the types of pressure measuring instruments?

5. What is Buoyancy law?

6. What is Meta Center?

7. What is Archimedes principle of buoyancy?

8. What is classification of flows?

9. What is meant by velocity measurement?

10. Write short notes on a)Surface floats b)double floats c) Rod floats?

11. Describe two types of current meter?

12. What is stream lines, streak lines and path lines?

Part – B

1. Explain briefly 1) Simple manometers and 2) Differential manometers?

2. Give brief explanation and expression on forces on a plan and curved surfaces?

3. Determine the meta centric height with experimental determination?

4. What are the conditions of equilibrium of floating body?

5. Derive an expression of continuity equation in one, two and three dimensional forms?

6. Explain in detail stream line, streak line and path line?

7. Derive an expression for stream and velocity potential functions?

8. How are floats used in velocity measurements? Describe the rod float and double float?

9. Explain about hot wire and hot film anemometer used in velocity measurement?

10. Describe Laser Doppler velocimetry ?

11. In a two dimensional continuous flow if u = kx, find v?

12. The velocity components in a two dimension flow of an incompressible fluid are u =2x and v = -2y.

State if flow continuous?

13. Determine the velocity components if the velocity potential function is given by pi = log xy?

Unit - III

Part – A

39. State The Equation Of Continuity To Three Dimensional In Compressible Flow.

40. State Bernoulli's Theorem As Applicable To Fluid Flow.

41. What Are The Three Major Assumptions Made In The Derivation Of The Bernoulli's Equation?

42. Write Down The Limitations Of Bernoulli's Equation.

43. Mention Any 3 Applications Of Bernoulli's Theorem.

44. Why Large Reduction Of Diameters From Inlet To Throat Is Not Allowed In Venturimeter?

45. Why Is Co-Efficient Of Discharge Of Venturimeter Always Greater Than Orifice Meter?

46. Write Down The Expression For Discharge Through A Venturimeter Explaining Each Term In It.

47. Why Pressure Difference Is Not Measured Between Throt And Exit?

48. What Is Venturimeter? And Explain Its Basic Principles.

49. What Are The Various Parts In Venturimeter?

50. Why Convergent Portion Is Smaller Than Divergent Portion ?

51 What Is Cavitations In Venturimeter?

52. What Are The Effects Of Cavitations In Venturimeter?

53. Define Co-Efficient Of Friction.

54. What Are The Advantages Of Venturimeter?

55. What Are The Disadvantages Of Venturimeter?

56. What Is Orifice Meter And Mention Its Basic Principle?

57. What Are The Advantages Of Orifice Meter?

58. What Are The Disadvantages Of Orifice Meter?

59.What Is Co-Efficient Velocity?

60. Define Co-Efficient Of Contraction.

61. How Can Pressure Be Measured In Pitot Tube?

62. What Do You Understand By Impulse Momentum Equation.

Part - B

1. Obtain an expression for continuity equation in Cartesian coordinates?

2. Sate and prove Bernoulli's Theorem.

3. State and explain Bernoulli's equation with assumptions?

4. Derive from basic principle the Euler equation of motion in two dimensional flow in x-y co-ordinate

system and reduce the equation to get Bernoulli's equation for unidirectional streamlined flow?

5. Draw the sectional view of Pitot's tube and write its concept to measure velocity of the fluid flow?

6. Differentiate between Venturimeter and Orificemeter?

1. A swimming pool of 8m x 15m is to be filled to a depth of 2.5m. Determine the inflow required in m

cube per second for a filling time of 90 minutes. If 40mm pipes are available and the water velocity in

each hose is limited to 2m/s, determine the number of hoses required?

2. A 400mm diameter pipe branches into two pipes of diameters 200mm and 250mm respectively. If the

average velocity in the 400mm diameter pipe is 2.2m/s, find the discharge in the pipe. Also determine

the velocity in 250mm pipe, if the average velocity in 200mm diameter pipe is 2.6m/s?

3. A jet of water from a nozzle of diameter 15mm is directed vertically upwards with a velocity of 12m/s. If the jet remain circular, workout its diameter at a point 3m above the nozzle tip. Neglect any loss of energy?

4. Water flows through a pipe AB of diameter 50mm, which is in series with pipe BC of diameter 75mm in which the velocity is 2m/s. At c the pipe forks and one branch CD is of unknown diameter such that the velocity is 1.5 m/s. The other unknown diameter such that the velocity is 1.5 m/s. The other branch CE is of diameter 25mm and condition are such that the discharge in pipe BC divides so that the discharge in the pipe CD is equal to two times of discharge in CE. Calculate 1. Discharge in pipe AB and CD. 2. Velocity in pipe AB and CE. 3. Diameter of pipe CD.

5. A vertical tube of 1m diameter and 20m long has a pressure head of 5.5m of water at the upper end.

When water flows through the pipe at an average velocity of 4.5m/s, calculate the head at the lower end of the pipe when the flow is upward.

6. Water is flowing through a tapering pipe having diameters 300mm and 150mm at sections 1 and 2 respectively. The discharge through the pipe is 40lit/s. The section 1 is 10m above datum and section 2 is 6m above datum. Find the pressure at the section 2, if that at section 1 is 400kN/m square?

7. The discharge through a horizontal tapering pipe is 60lit/s. The diameter at inlet and outlet are 25cm and 15cm respectively. If the water enters at a pressure of 1kgf/centimeter cube, determine the pressure at which it leaves.

8. Oil of specific gravity of 0.90 flows in a pipe 300mm diameter at the rate of 120 lit/s and the pressure at a point A is 25kPa. If the point A is 5.2m above the datum line, calculate the total energy at point A in terms of m of oil?

9. The water is flowing through a taper pipe having diameter 400mm at the bottom end and 250mm at the upper end. The intensity of pressure at the bottom and upper end are 250 and 100 kN per meter

square respectively. Calculate the difference in datum head, if the rate of flow through pipe is 30 lit/s?

10. Static pressure rise across a water pump is 200mm of water column. The suction and delivery pipe diameters are 100mm and 80mm respectively. Flow rate is 19.6 lit/s. Assume losses are negligible. Calculate power delivered by pump to the water?

11. Water is drawn from a reservoir through a vertical 300mm diameter pipe by a pump that discharges into a horizontal 150mm diameter pipe. The inlet pressure gauge reads a gauge pressure of -20kPa while the pressure gauge on the discharge side reads an absolute pressure of 150 kPa. Discharge rate is 0.05 meter cube /s. The vertical height between the inlet pressure gauge and exit pressure gauge is 1.5m. Calculate kW input to the water.

12. A 250mm pipe carries oil (specific gravity of 0.8) at a velocity of 20m/s. At points A and B of measurements of pressure and elevation were respectively 100kN/meter square and 60 k N /meter square, 5m and 8m respectively. For steady flow, find the loss of head between A and B and direction of flow?

13. A pipe is 15 cm diameter and is at an elevation of 100m at section A. At section B it is at an elevation of 107m and has a diameter of 30cm. When a discharge of 50lit/s of water is passed through this pipe, the pressure at the section A is 30 KPa. The energy loss in the pipe is 2m. Calculate the pressure at B when the flow is 1. from A to B 2. from B to A?

14. A mercury filled U-tube manometer connected across a Venturimeter records a difference of 30mm. Diameters at the inlet and throat of Venturimeter are 100mm and 50mm respectively. If oil of specific gravity of 0.85 flows through the horizontal pipe. Calculate the discharge. Take Cd = 0.9?

15. A vertical Venturimeter of (d/D) ratio equal to 0.6 is filled in a 0.1m diameter pipe. The throat is 0.2m above the inlet. The meter has a co-efficient of discharge of 0.92. Determine the 1. Pressure

difference as recorded by two gauges fitted at the inlet and throat. 2. Difference on a vertical differential mercury manometer (specific gravity of mercury = 13.6) when a liquid of specific gravity 0.8 flows through the meter at the rate of 50 lit/s.

16. An oil of specific gravity 0.85 is flowing through an inclined Venturimeter fitted at a 250mm diameter pipe at the rate of 110lit/s. The Venturimeter is inclined at 60 degree to the vertical and its 120mm diameter throat is 1m from the entrance along its length. The pressure gauges inserted at entrance and throat show pressures of 0.125 0.08 N/mm square respectively. Calculate the discharge co-efficient of Venturimeter. If instead of pressure gauges the entrance and throat of the Venturimeter are connected to the two limbs of a u-tube manometer, determine its reading in m of mercury column.

17. A 300mm x 100mm Venturimeter is provided in a horizontal pipeline to measure the flow of water.

The pressure intensity at inlet is 125 KN/meter square while the vacuum pressure head at the throat is 360mm of mercury. Assuming that 4% of head is lost in between the inlet and throat, find the coefficient of discharge and rate of flow through Venturimeter.

18. The coefficient of discharge for a Venturimeter used for measuring the flow of an incompressible fluid was found to be constant when the rate of flow Q exceeded a certain value. Show that under these conditions, the loss of head hf in the convergent portion of the Venturimeter can be expressed as k1Q square, where K1 is constant.

19. A bend in pipeline converging water gradually reduces from 700mm to 400mm diameter deflects the flow through an angle of 45 degree. Find the magnitude and direction of force exerted on the bend, if the velocity of low at 700mm section is 8m/s and pressure is 350kn/meter square?

20. A pipe having diameter of 300mm carries water under a head of 22m with a velocity of 4m/s. If the axis of the pipe turns through 165 degree. Find the magnitude and direction of the resultant force on the bend?

21. 200 litre/s of water is flowing through a 90 degree reducer bend of inlet and outlet diameter is 30cm

and 20cm respectively. The pressure at the inlet 200 kN/meter square (gauge) where as the pressure at the exit is atmosphere. Calculate the magnitude and direction of the resultant force on the bend?

22. Water at the rate of 0.2 meter cube/s flowing through a 400mm diameter fire hose, at the end of which a 100mm diameter nozzle is fixed. Calculate the force exerted by the nozzle?

23. Water flows through a 600mm diameter pipe at the end of which there is a reducer connecting to a

400mm diameter pipe. If the gauge pressure at the entrance of the reducer is 450 KN/meter square and the velocity is 2.5 m/s, determine the resultant thrust on the reducer, assuming the rate the frictional loss of head in the reducer is 2m.

24. A vertical jet of water 70mm diameter leaving the nozzle, with a velocity of 10m/s strikes a horizontal

and movable disc weighing 200N. The jet is then deflected horizontally. Determine the vertical distance y above the nozzle tip at which the disc will be held in equilibrium?

25. A metal plate 5mm thick and 200mm square swings about a horizontal edge. A horizontal jet of water 15mm in diameter impinges with its axis perpendicular to and 75 mm below the edge of the hinges and keeps its steadily inclined at 25 degree to the vertical. Find the velocity of the jet, if the metal plate has a specific gravity of 8.2?

Unit –IV

Part - A

1. Mention The General Characteristics Of Laminar Flow.

2. Write Down Hagen-Poiseuille Equation For Laminar Flow.

3. What Is Boundary Layer? Give A Sketch Of A Boundary-Layer Region Over A Flat Plate.

4. What Is Meant By Laminar Boundary Layer?

5. Describe Briefly Turbulent Boundary Layer.

6. Define Displacement Thickness.

7. Define Momentum Thickness.

8.Define Energy Thickness.

9. Write The Equation For Displacement Thickness And Momentum Thickness.

10. Define The Terms: Drag And Lift

11. What Is Meant By Boundary Layer Separation?

12. State The Effect Of Boundary Layer Separation.

13. Mention The Different Methods To Prevent Boundary Layer Separation.

14. What Are Energy Lines And Hydraulic Gradient Lines?

15. Define Critical Velocity

16. What Is Meant By Transition State.

17. Writ Down The Value Of Reynolds Number For Laminar, Transition And Turbulent Flow.

18.Write Down Four Examples Of Laminar Flow.

19.What Is Physical Significance Of Reynold's Number?

20.Differentiate Between Laminar And Turbulent Flow

21. What Is A Siphon? What Are Its Applications?

22. Write The Formula For Darcy-Weisbach Equation.

23. Where The Darcy Weishbach & Chezy's Formulas Are Used?

24.What Is Pipe?

25. Classify The Losses In Pipes.

26. What Are The Losses Experienced By A Fluid When It Is Passing Through A Pipe

27. Write The Equation Of Loss Of Energy Due To Sudden Enlargement.

28. What Are Eddies And Vena Contracta In Pipe Minor Losses?

29. Write The Expression Of Loss Of Energy Due To Sudden Contraction.

30. Write The Expression For Energy Loss Due To Entrance And Exit Of The Pipe.

31. Write The Formula For Loss Of Energy Due To Gradual Enlargement And Also Bend In Pipe.

32. What Are Pipes In Series?

33. What Is Equivalent Pipe ?

34.What Do You Mean By Flow Through Parallel Pipes?

Part – B

1. Derive Hagen – Poiseuile equation and state the assumptions made?

2. What is boundary layer and write its type of thickness?

3. Write short notes on 1) Laminar boundary layer 2) Turbulent boundary layer 3) Displacement thickness

4) Energy thickness 5) Momentum thickness 6) Drag coefficients?

4. Write short notes on hydraulic gradient in pipe flow?

5. Describe briefly the development of laminar and turbulent flows in circular pipes?

6. Derive and expression for Darcy Weibach formula?

7. Obtain the expression for Maximum efficiency of power transmission through pipes?

8. State Kirchaff's law and briefly explain with suitable example.

9. Explain the types of minor losses in pipes?

10. An oil of viscosity 0.023 N-s/meter square flows between two large infinite parallel plates by a distance of

15mm. Calculate the 1. The pressure gradient along the flow 2. the maximum velocity and 3. the

shear stress at the walls, if the average velocity is 0.35m/s.

11. Fluid of density 1200 kg/meter cube and viscosity of 0.1 poise flow between two infinite parallel plates

separated by a distance of 18mm. If the discharge is 0.8 litres/s per unit width of the plate, calculate

the pressure drop per unit length?

12. Two parallel are kept 25mm apart have laminar flow of oil (viscosity of 10 poise) between them with a

maximum pressure drop of 0.5N/centimeter square for a length of 1.5m. The width of the plat is

250mm. Calculate the rate of flow of oil between the plates?

13. A oil of viscosity 1.5 N-s/meter square flows between two parallel fixed plates which are kept at a distance

of 60mm apart. The maximum velocity of oil is 2m/s. Calculate: 1. The discharge per m length, 2. The

shear stress at the plates, 3. The pressure difference between two points of 10m apart along the

direction of flow, 4. The velocity gradient at the plates, 5. The velocity at 18mm from the plate?

14. A plunger of length 200mm and diameter 125mm reciprocates in the 200.2mm diameter cylinder. The

plunger and cylinder arrangement is used to pump the fluid of viscosity 0.5N-s/meter square.

Calculate the leakage past the plunger at an instant when the pressure difference between the two

ends of the plunger is 10m of water?

15. An oil container in a truck has a horizontal crack in its end wall which is 400mm wide and 40mm thick in

the direction of the flow. The pressure difference between two ends of the crack is 12kPa and the

crack area has a gap of 0.3mm between the parallel surfaces. Calculate: 1. Volume of the oil leakage

per hour through the crack. 2. Maximum leakage velocity 3. Shear stress and velocity gradient at the

boundary.

16. Lubricating oil of specific gravity 0.84 and dynamic viscosity 0.137 N-s/meter square is pumped at a rate

of 0.024 meter cube/s through a 0.17 diameter 400m long horizontal pipe. Calculate the pressure

drop, average shear stress at the wall of the pipe and the power required to maintain the flow?

Problems o Flow through Pipes

17. Calculate the power required to maintain to maintain 0.06 meter cube/s of oil (specific gravity 0.75)

through a steel pipe 300mm diameter and 130m long. Take coefficient of friction f= 0.04 in the Darcy

relation.

18. A pipeline 0.4m in diameter and 1250m long has a slope of 1 in 150 for the first 750m and 1 in 100 for the

next 500m. The pressure at the upper end of the pipeline is 120 kPa and at the lower end is 70kPa.

Taking f=0.025, determine the discharge through the pipe.

19. A pump is used to supply 5litres per second of water from a reservoir to a point 400m from the reservoir

at the same level as the reservoir surface. Diameter of the pipe is 32mmm and friction factor can be

assumed as 0.0009. Calculate the power supplied by the pump to the water.

20. A smooth pipe conveys 7.5 li/s of water with a head loss of 80mm per 10m lengths. Viscosity of water is 10

power – 6 meter /s. friction factor in the Darcy's equation is given by f=0.316/ (Re) power 0.25,

Determine the diameter of the pipe.

21. An engineering college having 1200 students is to be supplied with water from reservoir 12km away.

Water is to be supplied at the rate of 50 litres per head per day and half of the daily supply is

pumped in 8hrs. If the head loss due to friction is 55m, find the diameter of the pipe. Take f= 0.004.

Problems on Boundary Layer

22. A rectangular plate of 6m long x 4m wide is kept immersed in water which moves with a velocity of

0.6m/s. Calculate the thickness of boundary later at a distance of 2.0m from the leading edge. Take

kinematics viscosity of water as 1.1x 10 power of -6 meter square/s.

23. A stream lined train has 200m long 3m wide on the top surface. Find the thickness of boundary layer at a

distance of 30m from the leading edge when the train is running at 75km/hr. Take kinematics

viscosity of air as 1.6x 10 power of -5 meter square/s. Also find out the thickness of boundary later at

the trailing edge?

24. The velocity distribution in the boundary later is given by u/U = y/lamda where, u= velocity at a distance

y from the flat plate and u =U at y= lamda. Lamda = boundary layer thickness. Determine the value

of 1. The displacement thickness, 2. Momentum thickness, 3. Energy thickness.

Unit –V

Part - A

1.Give The Dimensions Of Following Physical Quantities

(A) Pressure

(B) Surface Tension

(C) Dynamic Viscosity

(D) Kinematic Viscosity

2. State The Fourier Law Of Dimensional Homogeneity

3. What Is Dimensionally Homogeneous Equation? Give Example.

4. What Are The Uses Of Dimensional Homogeneity

5.What Are The Points To Be Remembered While Deriving Expressions Using Dimensional Analysis?

6.State The Methods Of Dimensional Analysis.

7. How Are Equations Derived In Raleigh's Method?

8. State The Buckingham π Theorem .

9. Describe Briefly The Selection Of Repeating Variables In Buckingham π Theorem.

10. Define Weber Number.

11. Define Reynolds Number.

12. Define Mach Number.

13. State The Limitations Of Dimensional Analysis

14. What Are The Advantages Of Model Testing.

15. Mention The Applications Of Model Testing.

16.Define Similitude.

17.What Are The Similarities Between Model And Prototype?

18. What Is Meant By Kinematic Similarity

19. In Fluid Flow What Do

es Dynamic Similarity Mean? What Are The Non Dimensional Numbers Associated With Dynamic Similarity?

20. Mention The Significance Of Reynolds Model Law.

21.State Froudes Model Law

22. Write Down The Scale Ratio For Discharge, Energy And Momentum.

23.State The Euler Model Law And Give Its Significance.

24. Submarine Is Tested In The Air Tunnel. Identify The Model Law Applicable

25. Mention Types Of Models

26. What Is Meant By Undistorted Models

27. Define The Term Scale Effect

28.State 3 Demerits Of A Distorted Model

29.Obtain Scale Ratio Of Discharge For Distorted Models

Part - B

1. Explain briefly Rayleigh's Method?

2. Explain briefly Buckingham Pi Method?

3. What is Similitude and explain different similarities in model and prototype analysis?

4. Explain in detail about model or similarity laws?

5. What are the types of models? Explain them?

6. What is scale effects in model and also explain the scale ratio for distorted models?